Predicting coupled ocean-atmosphere modes with a climate modeling hierarchy

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The goal of this new project is to determine midlatitude climate predictability associated with tropical-extratropical interactions on interannual-to-interdecadal time scales. Our strategy is to develop and test a hierarchy of climate models, bringing together simple fluid-dynamical coupled ocean-ice-atmosphere models, advanced computationally intensive probabilistic network (PN) models, and large GCM-based climate models. A central aspect of the work is to use PN models to develop a new diagnostic methodology for analyzing coupled ocean-atmosphere interactions in large climate simulations made with the NCAR Parallel Climate Model (PCM), and to make these tools user-friendly and available to other researchers. Our scientific focus is on interactions between the tropics and extratropics through atmospheric teleconnections (the Hadley cell, Rossby waves and nonlinear circulation regimes) over both the North Atlantic and North Pacific, and the ocean's thermohaline circulation (THC) in the Atlantic. We will test the hypothesis that variations in the strength of the THC alter SSTs in the tropical Atlantic, and that the latter influence the atmosphere in high latitudes through an atmospheric teleconnection, feeding back onto the THC. Simplified primitive equations models will be used in conjunction with multi-century simulations made with the PCM, through the probabilistic network model framework. This is a new project and the talk will introduce our strategy and methodology.